

PATENT COOPERATION TREATY

PCT

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P17895WO1	FOR FURTHER ACTION See Form PCT/IPEA/416																	
International application No. PCT/SE2003/000589	International filing date (day/month/year) 10.04.2003	Priority date (day/month/year)																
International Patent Classification (IPC) or national classification and IPC H04L 1/18																		
Applicant TELEFONAKTIEBOLAGET LM ERICSSON (publ) et al																		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>6</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>9</u> sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> <p>4. This report contains indications relating to the following items:</p> <table border="0"><tr><td><input checked="" type="checkbox"/> Box No. I</td><td>Basis of the report</td></tr><tr><td><input type="checkbox"/> Box No. II</td><td>Priority</td></tr><tr><td><input checked="" type="checkbox"/> Box No. III</td><td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td></tr><tr><td><input type="checkbox"/> Box No. IV</td><td>Lack of unity of invention</td></tr><tr><td><input checked="" type="checkbox"/> Box No. V</td><td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td></tr><tr><td><input type="checkbox"/> Box No. VI</td><td>Certain documents cited</td></tr><tr><td><input type="checkbox"/> Box No. VII</td><td>Certain defects in the international application</td></tr><tr><td><input type="checkbox"/> Box No. VIII</td><td>Certain observations on the international application</td></tr></table>			<input checked="" type="checkbox"/> Box No. I	Basis of the report	<input type="checkbox"/> Box No. II	Priority	<input checked="" type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/> Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/> Box No. VI	Certain documents cited	<input type="checkbox"/> Box No. VII	Certain defects in the international application	<input type="checkbox"/> Box No. VIII	Certain observations on the international application
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Date of submission of the demand 15.10.2004	Date of completion of this report 19.07.2005																	
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 Form PCT/IPEA/409 (cover sheet) (April 2005)	Authorized officer Fredrik Blomqvist/MP Telephone No. +46 8 782 25 00																	

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/000589

Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☐ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 17 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 18 - 26 received by this Authority on 2005-07-11
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1 - 7 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application

☒ claims Nos. 13-27, 44

because:

☐ the said international application, or the said claims Nos. _____
relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. _____
are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. _____ are so inadequately supported
by the description that no meaningful opinion could be formed (*specify*):

☒ no international search report has been established for said claims Nos. 13-27, 44

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in a form and manner acceptable to it.

☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in a form and manner acceptable to it.

☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rules 13ter.1(a) or (b) and 13ter.2.

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, within the prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Preliminary Examining Authority in a form and manner acceptable to it.

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply with the technical requirements provided for in the Annex C-bis of the Administrative Instructions.

☒ See Supplemental Box for further details.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/000589

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-12, 28-43, 45-46</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-12, 28-43, 45-46</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-12, 28-43, 45-46</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention reduces impact of transmission errors by means of a retransmission protocol.

A method and apparatus of retransmission involving packet radio transmissions from user equipment to a control element connected to one or more radio base stations, where the acknowledging function is distributed, both the radio base stations and the control element connected to the radio base stations acknowledge packet data from the user equipment.

D1) WO 03019376 A1

D2) US 20030007480 A1

D3) 3GPP TS 25.308 v5.3.0 " HSDPA, overall description", stage 2

D1 describes a downlink ARQ and an uplink ARQ.

D2 describes a downlink ARQ where ARQ messages are sent between the MAC layer(UE and Node B) and the RLC layer(UE and RNC). The Node B transmits packet data to the UE and the UE transmits ACK/NACK to the Node B and RNC. The UE makes a soft combining by retransmitted data.

The cited documents represent the general state of the art. The invention defined in claims 1-12, 28-43, 45-46 is not disclosed by any of these documents. The cited prior art differ from the claimed invention in that neither of the documents describe a method and apparatus for reducing impact of transmission errors. Neither of the documents reveal " a retransmission loop involving a packet

.../...

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box III

The old claims 1-48 has after the amendments in the letter received by the Authority on 2005-07-11 resulted in the new claims 1-46.

No international search has been done on the subject matter in amended claims 13-27, 44. Therefore, no international preliminary report on patentability has been established for the new amended claims 13-27, 44 (which correspond to the old claims 13-29 and 46).

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

radio transmissions from user equipment to a control element connected to one or more base stations, the user equipment radio transmissions being received at one or more radio base stations for forwarding to a control element, the base station acknowledging positively or negatively transmissions forwarded to it". Therefore, the subject matter in claims 1-12, 28-43, 45-46 is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-12, 28-43, 45-46 is novel and is considered to involve an inventive step. The invention is industrially applicable.

CLAIMS

1. A method of reducing impact of transmission errors by means of a retransmission protocol, the method characterized in that a retransmission loop involving packet radio transmissions from user equipment to a control element connected to one or more radio base stations, the user equipment radio transmissions being received at one or more radio base stations for forwarding to the control element, the base station acknowledging, positively or negatively, transmissions from the user equipment and the control element acknowledging, positively or negatively, transmissions forwarded to it.
2. The method according to claim 1 characterized in that for a process of retransmission, if same transmitted packet information content is received more than once, the received transmissions are combined.
3. The method according to claim 2 characterized in that successive received packet transmissions of the same information content are combined in the base station prior to determining whether or not the radio base station should acknowledge the transmitted information content.
4. The method according to claim 2 or 3 characterized in that whether or not the packet information content is the same is determined by means of a new data indicator.
5. The method according to claim 4 characterized in that the new data indicator, accompanying packet information, is transmitted on a reliable control channel.

6. The method according to any of claims 2-5 characterized in that the process is identified by means of a process identity.

7. The method according to claim 6 characterized in that the process identity, accompanying packet information, is transmitted on a reliable control channel.

8. The method according to any of claims 1-7 characterized in that the control element reorders received packets.

9. The method according to claim 8 characterized in that the received packets are reordered into sequential order.

10. The method according to claim 9 characterized in that the sequential order is determined from RLC sequence number.

11. The method according to claim 9 characterized in that the sequential order is determined from MAC sequence number.

12. The method according to any of claims 1-11 characterized in that the method reduces delay of uplink transmissions, the delay being associated with the retransmissions.

13. A signal format for uplink transmissions from user equipment to radio base station of a radio communications system, the signal format characterized by signal elements allowing radio base station reception combining and acknowledgment of successive received transmissions concerning same data in uplink direction

prior to forwarding received transmissions, the signal elements comprising

- process identity,
- new data indicator, and
- 5 - payload,

the new data indicator indicating whether or not payload data of a process with identity as indicated by the process identity element has been transmitted previously.

10 14. The signal format according to claim 13 c h a r a c -
t e r i z e d i n that the process identity and new data indicator elements are more strongly protected by a forward error control code than payload.

15 15. The signal format according to claim 13 or 14
c h a r a c t e r i z e d i n that the process identity and new data indicator elements are transmitted on a control channel in synchronism with transmissions of the payload element.

20 16. The signal format according to claim 15 c h a r a c -
t e r i z e d i n that the control channel is a shared control channel of a UMTS or WCDMA system.

17. The signal format according to claim 15 c h a r a c -
t e r i z e d i n that the control channel is a dedicated control channel of a UMTS or WCDMA system.

25 18. The signal format according to any of claims 13-17
c h a r a c t e r i z e d b y the payload element comprising an integer number of radio link control protocol data units (RLC PDUs).

19. The signal format according to any of clams 13-18
c h a r a c t e r i z e d i n that the process identity,

new data indicator and payload elements are arranged for uplink transmission in a transmission time interval shorter than 10 milliseconds.

5 20. The signal format according to claim 19 characterized in that the process identity, new data indicator and payload elements are arranged for uplink transmission in a transmission time interval shorter than 4 milliseconds, e.g. 2 ms.

10 21. A radio network controller of a radio communications system characterized by

- 15 - receive means for receiving one or more transmissions originated in a UE in uplink direction from one or more radio base stations where the one or more transmissions in uplink direction have been pre-detected according to an ARQ protocol,
- receive means, for receiving first protocol data units,
- 20 - buffering means, for buffering received first protocol data units,
- segmentation means, for segmenting received first protocol data units into second protocol data units,
- 25 - reassemble means, for reassembling second protocol data units into service data units,
- transfer means, for transferring service data units, and
- reordering means, for reordering first or second protocol data units.

22. The radio network controller according to any of claim 21 characterized by

- processing means, and
- transmit means,

5 the processing means being arranged to verify second protocol data units according to an error detecting code and the transmit means transmitting positive or negative acknowledgments depending on whether or not the second protocol data unit is detected to be erroneous.

10 23. The radio network controller according to claim 21 or 22 characterized in that the reordering means rearranges the second protocol data units according to an RLC sequence number.

15 24. The radio network controller according to any of claims 21-23 characterized by receive means arranged for receiving first protocol data units concerning a particular connection from a plurality of first protocol data senders.

20 25. The radio network controller according to any of claims 21-24 characterized in that the first protocol data units are MAC PDUs.

26. The radio network controller according to any of claims 21-25 characterized in that the second protocol data units are RLC PDUs.

25 27. The radio network controller according to any of claims 21-26 characterized in that the radio network controller is a radio network controller of a UMTS or WCDMA system.

28. A radio base station characterized by

- receive means, for receiving one or more first protocol data units,
- a protocol entity, for processing first protocol data units, and
- 5 - transmit means, for transmitting acknowledgments and for forwarding of first protocol data units.

29. The radio base station according to claim 28 characterized by

- 10 - buffering means, for buffering one or more first protocol data units.

30. The radio base station according to claim 28 or 29 characterized by the protocol entity being arranged for verifying one or more first protocol data units according to a forward error control code, and depending on the outcome positively or negatively acknowledging to an uplink transmitting entity received first one or more protocol data units.

31. The radio base station according to any of claims 28-30 characterized by means for combining received first protocol data units, the protocol entity being arranged to verify the combined protocol data unit according to a forward error control code and depending on the outcome positively or negatively acknowledging to an uplink transmitting entity the latest received protocol data unit of the combination.

32. The radio base station according to claim 31 characterized in that the first protocol data units with same process identity are combined according to a received new data indicator.

33. The radio base station according to any of claims 28-32 characterized in that the first protocol data units are MAC PDUs.

5 34. The radio base station according to any of claims 28-33 characterized in that the radio base station is a radio base station of a UMTS or WCDMA system.

35. A user equipment apparatus of a radio communications system characterized by

- 10 - assemble means for assembling one or more second protocol data units into one or more first protocol data units,
- buffering means for buffering first protocol data units,
- 15 - transmit means for transmitting first protocol data units according to an ARQ protocol,
- receive means for receiving one or more acknowledgments of first protocol data units, and
- receive means for receiving one or more acknowledgments of second protocol data units.

20 36. The user equipment apparatus according to claim 35 characterized by the transmit means being arranged to retransmit one or more first protocol data units if negatively acknowledged or not positively acknowledged within a predetermined time.

25 37. The user equipment apparatus according to claim 35 or 36 characterized by buffering means being arranged to release buffer space of one or more first protocol data units if positively acknowledged or not negatively acknowledged within a predetermined time.

38. The user equipment apparatus according to any of
claims 35-37 characterized by transmit
means being arranged to transmit first protocol data units
in transmission time intervals shorter than 10 millisec-
5 onds.

39. The user equipment apparatus according to claim 38
characterized by transmit means being ar-
ranged to transmit first protocol data units in transmis-
sion time intervals shorter than 4 milliseconds, e.g. 2
10 milliseconds.

40. The user equipment according to any of claims 35-39
characterized in that the first protocol
data units are MAC PDUs.

41. The user equipment according to any of claims 35-39
15 characterized in that the second protocol
data units are RLC PDUs.

42. The user equipment apparatus according to claims 35-41
characterized in that the user equipment
apparatus is user equipment of a UMTS or WCDMA system.

20 43. Radio communications system characterized
by means for carrying out the method in any of claims
1-12.

44. A radio communications system character-
ized by a plurality of radio network controllers ac-
25 cording to any of claims 21-27.

45. A radio communications system character-
ized by a plurality of radio base stations according
to any of claims 28-34.

46. A radio communications system characterized by a plurality of user equipment apparatuses according to any of claims 35-42.